

## **Click Go the Students, Click-Click-Click**

### **How to give and gain students feedback to dynamically modify delivery in the classroom to students' needs**

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#### **Background**

How many of us have presented a lecture to a room of students over one, two or three hours with little interaction or feedback as to how much they understand what has just been presented? It would be great to have some feedback about their understanding of the material being presented. Not when they do the final exam but when we can do something about it. It would be invaluable to hear from each student what they have not understood, if not learnt.

We ask questions only to be answered (if at all) by the best students while the timid, average or less articulate students just sit there even though they may not have understood. Some students do not respond to questions or request for feedback due to the fact that even though they are physically in the classroom their minds are somewhere else. They are thinking about other things or courses/subjects – leave you to guess what's on their minds and gaining their foremost attention. Other students do not respond for fear of retribution either from their fellow students or from the teacher whom they perceive may think of them as 'dumb'. Some don't answer because they can't put into words what is concerning them. This could be because they are not sure what to say or in the case of many overseas students, they perceive they can't express themselves adequately in English. Many students have a fear of speaking in a group and don't respond from a fear of looking inept. There is always a group of students that answer or attempt to answer every question and dominate, leaving no chances for other less assertive students to respond. Then there is the group of students that do not understand or follow the logic of the argument presented. This group is not mutually exclusive of the other groups' described sharing similar characteristics. It is purported that there are many students in our classes that can't follow the content delivery, particularly at the pace at which material is delivered in contemporary classrooms and courses. More material is being crammed into courses and programs without full recognition given to the need for the additional time required to cover the material. This produced one-way communication with little feedback from, and interaction with, students.

Traditional approaches to gaining feedback through the use of questions and quizzes have a lot to be desired. This paper presents a technology-based solution that is not new but has evolved into a feedback mechanism which provides lecturers with a non-intrusive but effective pedagogy. It provides a method that can overcome many of the barriers presented above while giving and gaining student feedback to dynamically modify delivery in the classroom to help focus on students' needs as identified by students themselves. Various described a 'clickers', audience response systems, personal response systems, and

student response systems, they have evolved as an effective technology in education and training but have been popularised in TV game shows such as “Sale of the Century”.

### **History and Use of ‘Clickers’**

The concerns about feedback from students and maintaining their engagement in a classroom has been well researched and documented (Ames 1992, Strong et al. 1995). Solutions to these concerns have been variously attempted some with limited success. One approach was to use PowerPoint which grew ever since Microsoft acquired and then released the software in 1987. Use of graphics and animations in presentations can live up the visual appeal and student recall (ChanLin 1998, 2000, Lowry 1999, Szabo and Hastings 2000). Eventually it became gimmicky and passé as more presenters used similar libraries of images and transitions (Coursey 2003). PowerPoint came in for much criticism and this created anti-PowerPoint literature (Powell 2005, Tufte 2003a, 2003b). However, many believed that this approach to presentations was an advance on chalk boards, white boards and OHPs (Cassady 1998, Gabriel 2008, Perry and Perry 1998, Susskind and Gurien 1999, West 1997). This technology is in the main used to enliven one-way communication between presenter and audience with little two-way interaction (as described earlier) that is possible through an effective response system.

Evidence suggests that response systems date back to the 1960s. Stanford University installed a system in 1966 and Cornell University followed in 1968 (Littauer 1972). In this early incarnation, prior to the microprocessor, systems were used for tallying student responses in lectures with minimal application to promoting student interaction. Early tests showed that student feedback to their use was positive but no gains in students’ achievements were obtained empirically (Bapst 1971, Bessler and Nisbet 1971, Judson and Sawada 2002). During the 1980s, the Personal Response System (PRS) was developed. It was a ‘wired’ device that was used narrowly for marketing and entertainment. In the 1990s, Audience Response Systems (ARS) were introduced that were ‘wireless’. The technological advances allowed wireless devices to be used more broadly in political polling and education. In the 90s, education commenced using Student Response Systems (SRS) with positive effects. Empirical studies identified increased attendance by students to classes that used SRS devices and there was a positive attitude towards SRS-supported classes and systems.

According to DCT-Worldwide (CNET News Website, 2005), a market research firm:

- in 2003 over 500,000 clickers were sold;
- in 2004 over one million units were sold;
- in 2008 over eight million units are anticipated to be sold.

### **Student Response Systems Technology**

Socrates over 2500 years ago laid the foundation of effective pedagogy to instil in students the ability to think about a problem, establish a position and commit to a response as the way to promote learning. In the 1980s the Oxbridge tutorial system in the UK formally adopted this approach where a few students met with their professor. However, in our crowded classroom and lecture theatres, it is almost impossible to apply the Socratic approach effectively to actively involve each student all or most of the time (Abrahamson 2006). With the development of and improvements to SRS technologies (and their variants), SRSs have increased in popularity in education and training in the last decade as a way of gaining feedback from students in real-time. One of the advantages of using the technology is that it maintains a student’s anonymity (they can answer without being individually associated with the response, wrong or right) while allowing instructors to check progress of students understanding.

Commonly known as ‘clickers’ but broadly defined as Audience Response Systems (ARS), Personal Response Systems (PRS) or Classroom/Student Response Systems (CRS/SRS), the clickers themselves are remote response devices to send students’ responses to questions displayed from a computer. Typically the

technology involves a hand-held device (clicker) or wireless transmitter that use radio frequency or infrared technology with an alpha-numeric keypad that allows students to respond to questions, which are usually in a multiple-choice format. Some systems allow responses in free-form text. The question is typically displayed as a PowerPoint slide that can be embedded in a normal slide set. Additional software that works in consort with PowerPoint, allows the design of the question slide to include feedback information such as graphical representation of responses.

Student responses are captured by a wireless receiver and software on lecturer's computer. The computer software records responses and collates them into a database. Results of the class' overall aggregate responses to questions are usually shown in graphical form showing the percentages of correct and incorrect answers or number of responses to each multiple choice question. The main benefit for all class participants is the instant feedback generated for the instructor and students. The instructor can then respond to any misunderstood concepts or questions (EDUCAUSE 2005). As a result of the feedback, an instructor can review what is not understood, provide an explanation for a misunderstood concept, provide additional examples to illustrate incorrect responses, or proceed on to the next part of the instruction if students have comprehend the material. This use of SRSs (adopted for this study) can be loosely described as a 'formative' approach. However, many SRSs are used in a more 'summative' way, where answers are gathered at the end of a lecture or as an assessment item.

On completion of the class or classes, statistical analysis can be undertaken in a variety of ways using the software that was used to develop question formats. Analysis can be undertaken on a quiz or multiple quizzes to see if there is a pattern as to what concept(s) are being misunderstood. As each response is stored for every student (if identified through the device's electronic ID), comparisons can be made across the course for a particular student or across classes to see what progress has been made (Fan and Van Blink 2006). In addition, analyses can be undertaken to see if there is an association between performance in quizzes (either formative or summative) and end of course examination or final grades.

Recent developments in SRS technology have improved the reach of this form of pedagogy. Enhancements are being made daily but one of most interest is the ability to have students on different campuses or on the Internet, respond to quiz questions at the same time as the students in the classroom with the instructor. Another variant of an SRS permits students to respond via their mobile phone or pocket PC/PDA. There are a number of suppliers of SRSs however this paper reports the application of one of these, namely KEEpad® from TurningPoint® Technologies<sup>1</sup>.



Figure 1 Clicker device

### Overarching Project

Over an extended period, a project has been undertaken (and is continuing) to evaluate the use of education technologies in teaching and learning. Titled the Dynamic Education project, its goal is to reduce the gap in information provided to and obtained by external (distance) students as compared to on-campus students. Much information is imparted to on-campus students that is not captured for off-campus dissemination, described by the project as the 'soft' information gap. 'Soft' information is defined as information and activities that are undertaken in classes that is not captured for all students. On-campus students capture 'soft' information by taking notes and participating in class. Off-campus students (including full-time students that have not attended the class and external students) are not there to capture what additional

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<sup>1</sup> The authors gratefully acknowledge the support provided by KEEpad Interactive in supplying the hardware and software for the study. ([www.keepad.com](http://www.keepad.com))

discourse has occurred and been verbally added to explain material on slides, what was written on a whiteboard, and what responses were made to students' questions by the instructor – all 'soft' information. This situation may create inequities for students that do not have the advantage of accessing 'soft' information. Thus the Dynamic Education project was born to redress this inequity and ensure that through the use of digital education technologies it was possible to go beyond capturing 'soft information' to provide opportunities to include students no matter where they are located while taking a teaching/ learning session.

The Dynamic Education project is divided into three phases – Phase 1- Dynamic Teaching, Phase 2- Dynamic Learning, and Phase 3- Virtual Classroom (Mula 2008a). In Phase 1 (Dynamic Teaching now complete) main objectives were to:

- maximise student engagement through
  - moving teaching from a static process into a dynamic engagement with the learners;
  - reducing the gap between on-campus and external off-campus students through capturing the teaching/information imparted during class time – 'soft' information.
- moving away from didactic theory where the tendency is to see teaching as the transmission of knowledge (Biggs 2002). This helps to support the diverse student body and learning styles while at the same time increasing inclusivity for students with disabilities and barriers to learning (James and Baldwin 1997).
- reducing collusion as it is a major issue when dealing with quantitatively based courses that make expansive use of computers and digital files. Issues raised by Boud (1995) provided some insights for developing assessment items that are complimentary to learning.

During this phase all class sessions (lectures, tutorials, labs) for an undergraduate first year course in accounting were:

- digitally captured (audio, video and digital writing [e-ink]) through use of a variety of wireless technologies (tablet PCs, PDAs, digital pens, digital paper) to test their efficacy. This approach built on research already completed and on-going in the Dept of Mathematics and Computing at the University with considerable success (Loch and Donovan 2006);
- recording of sessions (using Camtasia®) including all class activities (voice, video, annotations, questions and answers) that were uploaded to the StudyDesk (in WebCT®) for access by all off-campus and on-campus students. Some classes were also broadcasted from the University's TV studio to test this technology's effectiveness.

Work was also completed on reducing the incidence of plagiarism and collusion which saw large databases of randomised questions developed so that each student's solution was unique (not reported here).

Student feedback during Phase 1 was positive. A few comments made by students on their evaluations at end of semester are as follows.

***Very interactive lectures are a fantastic idea.***

***This is an acknowledgement that I am out here as an external student. I find the live lectures so necessary and thank you for the opportunity to be able to watch them via the internet.***

*I find viewing the lectures add a little extra to my learning by actually hearing the information in a different format and getting little bits of info you don't get in the Study Book or text book which help your understanding a little bit more. The classbook tool is great!*

*Many thanks for the live lecture. I am external and being able to see this has made a big difference to my understanding. Many thanks.*

Phase 2 (Dynamic Learning now complete) extended the findings from Phase 1 with the main objective to:

- maximise student interaction through
  - a pedagogy that facilitated dynamic engagement with learners;
  - introduced innovative pedagogies that provide a simulated on campus learning experience for all students.

During Phase 2, the following enhancements were introduced:

- technologies introduced in Phase 1 were extended for the same undergraduate course but with a different cohort of students through
  - the use of PDAs, tablet PCs and other wireless equipment that students were provided so they were able to interact during learning and teaching events;
  - the use of feedback methodologies and technologies to enable the instructor to poll the class to gauge their understanding of concepts and to adjust the delivery dynamically to enhance their learning (KEEpad® [clickers] and Turning Point®) – the focus of this paper.
- new streaming and capturing technologies were applied to broadcast live and upload multi-media teaching and learning events onto the StudyDesk (WebCT®) using a MediaSite PC (a specially built PC to stream and record sessions) and Elluminate®.

Student feedback following the end of the next semester continued to be positive.

*As an external student the broadcast lectures are much appreciated. They motivate me to keep up with the study schedule.*

*This is just to let you know that I have viewed the lecture regarding assignment 3 and as an external student found it helpful in filling in the bits of information I have missed esp as I have never used MYOB. I have watched it in bits over the last 2 days and am thankful such a resource is available.*

*I think that the recorded lectures are great. I would be so lost without them. I wish that more of the other subjects would start recording their lectures as well. As an external student i feel that the recorded lectures just make the information sink in that little bit better.*

### **Clicker Study**

In keeping with the concept of dynamic engagement, the introduction of clickers was an important addition to the education technologies applied in the project during Phase 2. To evaluate their efficacy, the clickers were used in lectures, labs and tutorials in the same undergraduate first year accounting course throughout one semester (as well as in an intensive law course).

In order to gauge students' responses to the technology and their effectiveness in the dynamic learning process, the same set of questions were used in all sessions for all concepts across three semesters reported for this study. For the first semester, the questions were embedded into traditional presentations of

PowerPoint slides in lectures. At regular intervals during the lecture, two to three questions were asked to which students responded verbally. This was to provide feedback to students of their understanding but more importantly allowed the instructor see what is being understood. In tutorials and labs, a set of ten quiz questions were asked at the end of sessions to review past weeks' work to again identify areas that needed further work. As expected, very few students responded verbally for many of the reasons identified in the literature, discussed earlier. To overcome the inequity issue between on- and off-campus students, these questions and answers were recorded. In addition, a set of randomly generated quiz questions were developed and distributed each week via the StudyDesk using WebCT, so that all students had additional feedback including pointers to revision materials.

During the second semester of the study, clickers were introduced into the teaching and learning environments. The clickers were handed out at beginning of class and collected at the end. The same clicker was given to the student each time, so that at the end of semester some analysis could be undertaken to see if there was an association between students' correct responses and other marks. At intervals of 15 to 20 minutes two to four multiple choice questions posed on the preceding 15-20 minutes lecture presentation. This provided feedback to students on their understanding but more importantly allowed the lecturer to dynamically change the presentation to reflect students' understanding or misunderstanding. As each question was displayed, students had a set time to respond. Once the time elapsed, no student could add a response and the accumulated results from all students was displayed in a bar graph, identifying the correct response with a percentage of the class that answered correctly and the percentage that chose each of the other incorrect choices to the multiple choice question. In tutes-labs clickers were used at end of session to review past weeks' work to again identify areas that needed further revision. In this semester the reaction and response rate was much different. By using clickers all students were happy to respond as the students' responses were anonymous. Clickers provided full information on the class' (around 50 to 60 students in a lecture session) and every students' understanding of the material. In lectures, the instructor was able to revisit concepts not understood over the last 15 to 20 minutes. This minimised the problem of progressing onto more advanced concepts without an understanding of foundation concepts.

For tutorials, students were given 10 to 15 multiple choice questions covering the topic delivered the previous week and for which exercises were completed during that tutorial. Unlike lectures, these questions were given as a set without any feedback until the end of the question set but all questions needed to be responded to in a time limit, usually 10 seconds. At the end of the question set, each question responses were reviewed in graphical form. Again, this allowed the tutor to pinpoint any concepts not understood well by all students or a majority. Thus tutorials became more productive and focussed on students' needs rather than a few students who, under the traditional method, would ask questions or would not be reticent to verbally respond to multiple choice questions in a class environment.

As part of this undergraduate accounting course, the students are introduced to the application of MYOB using a case study. Sessions are held in a PC lab where there is a smart-board (a digital whiteboard) as well as a virtual clicker system. The clicker keypad is displayed on the screen and students can respond by selecting a number or alpha character as well as enter responses as free-form text. This system was used to test its efficacy in such an environment for teaching software applications. Students responded well to the vPad® system (supplied by KEEpad® Technologies) and it enhanced the interaction between tutor and students in demonstrating software.



Figure 2 vPad®

In the following semester, the same pedagogy was used as in the first semester. As predicted, students' reactions to in-class quiz questions were the same – very few and very limited. This did not provide a basis

upon which, lecture materials and delivery could be varied to meet the needs of all students' understanding nor adequately revise material that was being misunderstood.

It was intended to have appropriate software and hardware to gain responses from external and distant campus students during the session being conducted at one campus. This again supports the objective of the Dynamic Education project to reduce the 'soft' information gap and minimise inequities in access to all information by off-campus students. Students can respond with response devices other than clickers using wireless, GPRS or SMS through mobile phones and pocket PCs. However the necessary equipment did not arrive on time from the USA. It is hoped that these distance-busting technologies will be evaluated in the third phase of the Dynamic Education Project – the virtual classroom. Some comments from students in support clickers use along with some simple data collected are discussed below in an attempt to answer the study's research questions.

### **Research Questions**

The study was designed to provide some answers to the following research questions.

Is a student response system (SRS) form of education technology perceived by students as useful in improving their understanding of course materials presented?

Can the same benefits be gained not using SRS education technology?

Does a SRS

- Increase student participation in classes?
- Provide quality feedback of students' understanding?
- Improve student performance in assessments?

To gain answers to these questions, data was collected from students using an action learning approach as described above.

During the last two weeks of semester, students were asked to provide feedback (using clickers) on a number of learning technologies and pedagogies (traditional and innovative) used during class sessions. The question relating to the use of SRS (clickers) was:

*I found the quiz completed in classes useful feedback to my understanding of the material being presented – yes/ no.*

Students' achievements on quiz questions delivered in class and on other assessment items as well as final grades were compared to see if there was an association. Comments were also collected from end of semester anonymous course evaluation questionnaires.

### **Student Feedback**

Student feedback on the use of clickers was extremely positive as has been found in other studies (Williams 2003, Richards et al. 2006).

*Never had so much fun in a class.*

*Told me where I had to revise.*

*I am sure most of you agree, that .... deserve a special thank you for delivering a course in such a way that makes accounting interesting - if that is possible. The resources that I have used through out this course have*

*been fantastic and very helpful and I have not come across anything like this in any courses I have done before.*

*Just want to say Thank you so much for your effort and help to make this course a very successful one. This is the best part of my studies so far. I've learned a lot on this subject and guaranteed that, i'm going to use this knowledge in the near future.*

The technology used during one intensive-mode law course proved beneficial according to students and the lecturer involved.

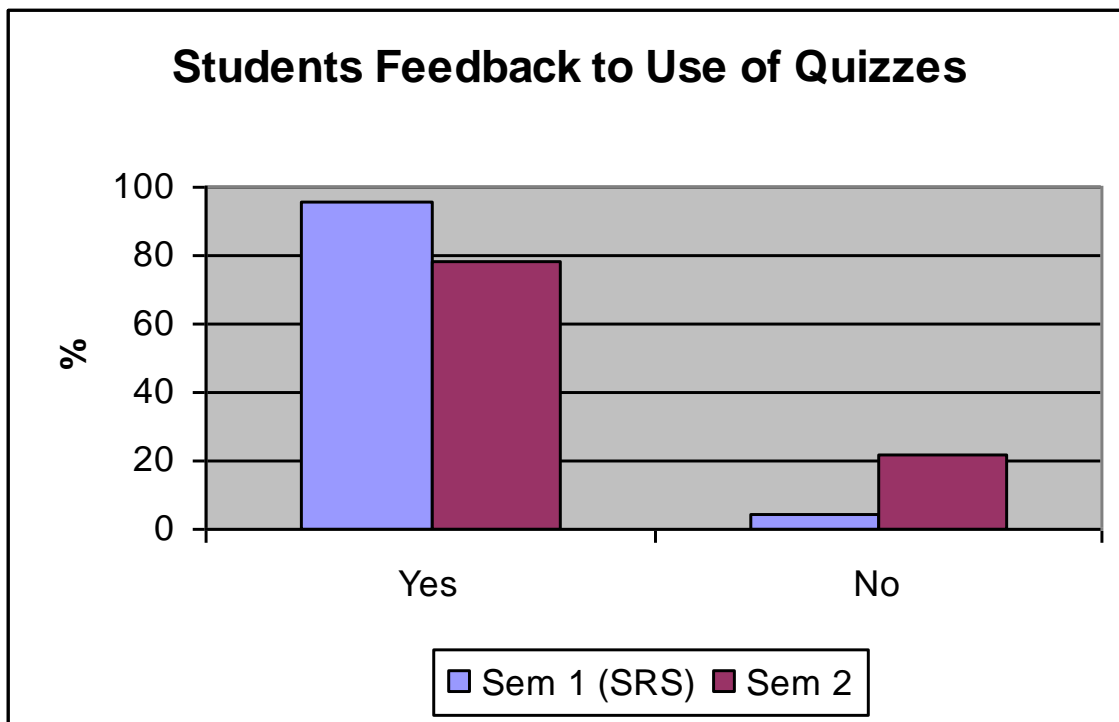


Figure 3 Students feedback on use of quizzes with (Sem 1) and without (Sem 2) SRS clickers

Based on the responses to the question asked of students that related to SRS technology, there was an increased perception of the usefulness of clickers to their understanding of the material. As the numbers were small there was no test of significant difference undertaken as they would not be statistically reliable. If the software was available to include external students, the statistical test would have been undertaken. Thus it can be tentatively concluded that students do perceive that SRS education technology is useful in gaining an understanding of material presented in classes. Students that did not have clickers available in the first semester of the study still found the use of quiz questions during presentations useful so this pedagogical approach may contribute to their understanding, even if they do not respond to the questions verbally.

### Observed Behaviour

Having taught the same course over five semesters, it was quite clear that students respond to education technologies in the classroom. Prior to introducing any education technology (and commencing the Dynamic Education project), the course was taught for two semester, one of which was at a campus in China that was a partner of the University. This experience triggered the project. The next semester was also delivered with few technologies, mainly the traditional PowerPoint and a standard PC. The third semester saw the introduction of Phase 1 of the project but still no clickers were used. This semester formed the base line against which Phase 2 was measured which was implemented in semester four and included clickers. Again,



the fifth semester did not use clickers but other non-SRS education technologies were applied, as the clicker technology was not available.

Based on observations by lecturers and tutors, it was obvious that students' responses were more complete and willingly provided when clickers were used than without them. Instructors also indicated that they were able to more easily pinpoint areas that students did not fully understand. They indicated that assertive students did not dominate what was covered in reviews and did not dominate question time. Consequently it was felt by all teaching staff that clickers provide a pedagogy that allowed dynamic delivery and interaction between all class participants so that students' needs were more effectively met.

This it was concluded that there is an increase in student participation in classes. The response to feedback from and by students displayed that they enhanced their understanding. However, using correlation analysis, no associations were found between students' collective results from in-class quiz questions and other assessment items or final grade in the course. That being said, what was identified was a decrease in the percentage of failures (and consequently an increase in passes) after the start of the Dynamic Education project in comparison to the semesters before the project commenced. SRS (clickers) was only one education technology introduced in Phase 2 and although the trend in reduced failures continued from Phase 1, it also was maintained in the last semester of the study when clickers were not available.

### Additional Evidence Collected

While delivering a version of this paper to an accounting education group at a recent conference, a number of questions were posed to the assembled academics (around 30) to gauge their understanding and perceived usefulness of SRS technology (Mula 2008b). Questions were posed as part of the presentation not only to gather some data but also to gain feedback from participants thus allowing dynamic adaptation of the presentation. Respondents were provided with clickers to answer the questions but also to demonstrate their use. Each question posed and the results obtained follow.

1.) To what extent do you experience response to questions in your classes?

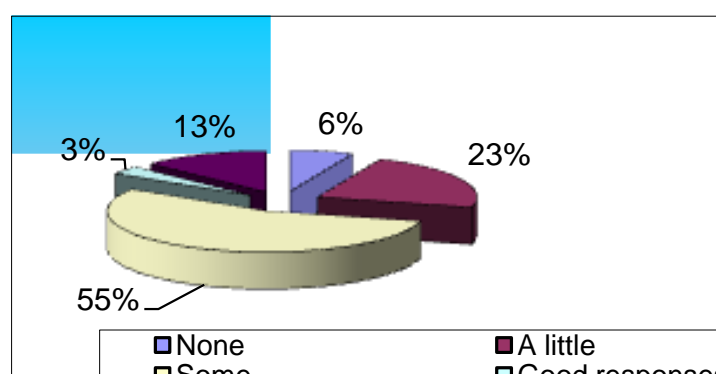


Figure 4 Academic perceptions – student response to questions in class

Some twenty-eight percent indicated that that get little to no response from students to questions in classes. Only sixteen percent say that the level of responses are good to excellent leaving fifty-five percent saying some response is experienced.

2.) How assertive are students in your classes?

To gauge the assertiveness of students in classes, this question shows that across a variety of universities in Australia and New Zealand students are not very assertive. This would inhibit the feedback that would be obtainable by instructors. By far the majority of respondents (over 68%) indicated that students were

somewhat to not at all assertive. This may reflect the mix of students' backgrounds with many universities having a good proportion of students coming from cultures that do not encourage questioning the teacher.

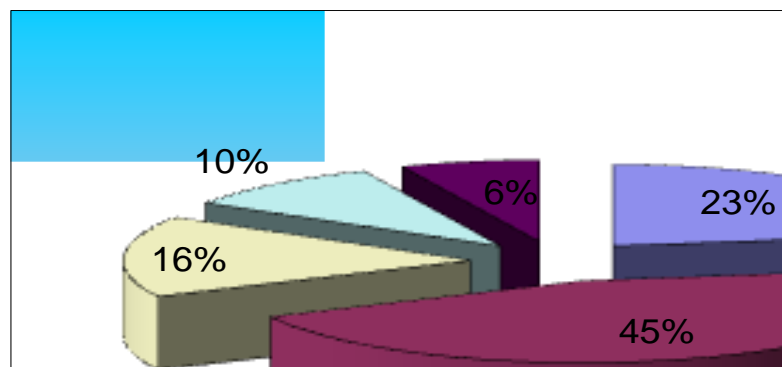


Figure 5 Academic perceptions – student assertiveness

- 3.) Have you heard of 'clickers'? and
- 4.) If you have access to SRSs, do you use SRSs in your classes?

As may have been expected, over eighty percent of academics have some knowledge of SRSs. Interestingly only forty percent (half of those that have heard of SRS) have access to SRSs in their institutions. What is even more interesting is that very few (14%) of those that have access to SRSs use them. Perhaps this study may encourage more of those that have clickers available, to use them in classes and those that do not have them, to gain support for their acquisition.

- 5.) SRS can improve class participation?

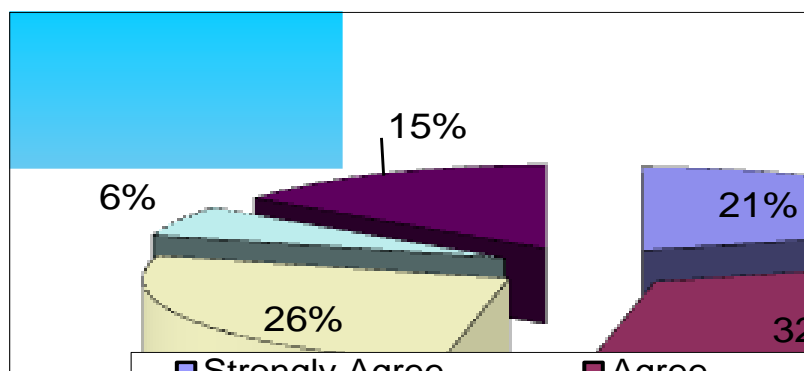


Figure 6 Academic perceptions – improve class participation

Over fifty-three percent of academics agree that clickers could improve class participation. However, there are around twenty percent who disagree, with a quarter of respondents not sure. This could be as a result of sixty percent who currently do not have access to clickers and of the ones that do have devices, very few use them in classes.

- 6.) SRS can provide feedback from students to improve my teaching

Over fifty-two percent of respondents agree that the use of SRSs can provide the necessary feedback to improve their teaching. Those respondents that were non-committal on this question (around 16%) is less than the previous question which may mean that academics see there is a possible benefit for themselves more so than for students.

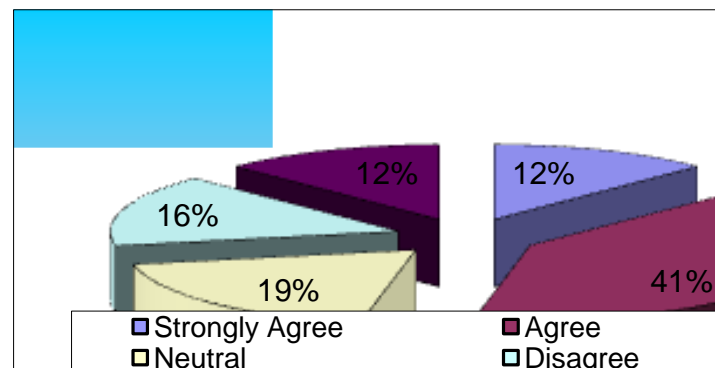


Figure 7 Academic perceptions – improve teaching through SRS feedback

7.) There is academic staff resistance to introducing education technology in my Uni

Finally, the last question attempted to probe whether technophobia exists in universities as it relates to education delivery. Over forty-four percent of respondents believe that it does whereas some twenty-seven percent do not. This finding might provide some evidence as to why academics that do have access to education technologies such as clicker are not using them in classes.

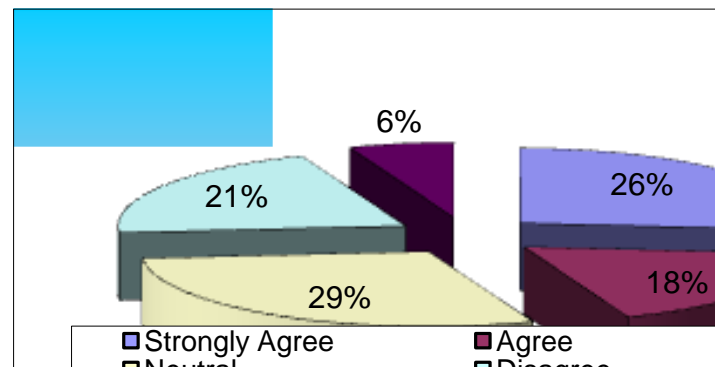


Figure 8 Academic perceptions – resistance to education technology

### Lessons and Limitations

A number of problems arise when attempting to introduce education technologies. Some of these stem from the lack of acceptance of these technologies by academics. Teaching staff felt technology intrudes on their traditional pedagogy of delivery and inhibit or hamper their style. Consequently, one limitation of this study was that instructors teaching the same course on other campus made very little use of the equipment provided, including clickers. More training will be undertaken in future implementations of education technologies before the semester starts.

Most students are comfortable with technology but some mature-aged students are not. The clicker technology is simple for students to use and does not take a lot of training for students to use the devices effectively. However, it would be a different matter when students are at a distance and where they are using a variety of devices not all of which have the same procedure for submitting answers. This may become unmanageable for some academic staff if not well trained and without adequate procedures for students to follow.

The study reported has a number of limitations in terms of its design and conclusions reached. The number of students that participated is small and in the main only from one course. The SRS technology was used in one semester only and a longer time period is needed to fully test SRSs. Data collected from students

perceived benefit is also limited as the clicker technology was only one part of a larger project's data collection. Thus the conclusion must be read with in these limitations and any conclusions are tentative.

### **Conclusion and Future Research**

Given the limitations of this study, it may be concluded that there appears to be some instructor and student benefits to be gained from the use of SRS technology in classes. Based on the analysis of students' feedback both qualitative and quantitative, it would appear that student responses to questions posed in classes will increase. If used as a means of modifying delivery of material to meet the needs and understanding of students, instructors more easily extract information to dynamically change their delivery to a large group of students without being concerned that not all students' voices are heard.

For future study, two major areas are being evaluated as part of Phase 3 of the Dynamic Education project. The first relates to the application of SRS technology with the types of response devices used, and the second to address some of the limitations identified in the uptake of education technologies by academics. An evaluation of integrating SRS into delivery method used during lectures will be undertaken. By using a series of questions to deliver content rather than just gain feedback on content delivered, would be an interesting pedagogical experiment. This may be more appropriate to quantitative material like accounting and mathematics than more qualitative course material. However, with a vPad-type response device, qualitative response would be able to be captured. Issue identified earlier that would permit external students or students on different campuses to respond to questions, will also be investigated in Phase 3. Use of mobile phones, pocket PC and PDAs as well as tablet PCs will be evaluated to see if these technologies would reduce inequalities emanating from being at a distance.

The conclusion reached at the end of Phase 2 was that Phase 3 (virtual classroom) could not be commenced until education technologies were useful and used by a majority of teaching staff, through simplification and in a form that was unobtrusive. Thus a sub-project (AID as described below) was formulated to help overcome some of the technophobic reactions encountered during the project and study.

Academics that are more technology savvy (innovators) can build sophisticated technology delivery platforms but they are in the minority, around three percent, with early adopters forming only an additional 10 to 20 % (Geoghegan 1994). A solution is needed that is acceptable to the majority of academics if the whole flexi-mode approach is going to succeed. Taylor (2001) cites Dolence and Norris (1995) who argue that to survive into the information age, organisations needed to be "fast, flexible and fluid". In addition, as technology continues to advance and universities look to take advantage of them to respond to the dynamic changing nature of learning and their learners desire to learn in their time and space, we need to overcome this hurdle of complexity.

This hurdle is common to all proponents of technology enhanced learning, irrespective of discipline or institution and thus some solution would have wide application. A number of reasons have been cited for this hurdle (Twigg 1994, Hiltz 1994, and Harasim 1990). One key finding is that professional identity is a source of opposition but it can be turned into an agent for change (Jaffee 1998). To understand this phenomenon, Rogers' (1983) diffusion of innovation model will be applied and tested building on the work of Geoghegan (1994) who evolved a conceptual framework for education institutions (based on Rogers' model). In addition, institutional perspective model will be applied as it has been shown to provide a number of further insights (Twigg 1994). The proposition to be evaluated by this study was postulated by Jaffee (1998) but apparently not tested:

***that the receptivity and perceived legitimacy of new educational delivery modes is strongly related to the extent to which these instructional technologies reinforce or retain the central elements of the institutionalized and identity-enhancing classroom settings.***

Once there is a common understanding of the hurdles and technology needs of teaching staff (by survey and focus groups), this proposed study will design and pilot test an integrated system called Academic Interactive Dashboard (AID). AID will provide a set of basic controls that will integrate all the key learning technologies on a one touch/pointer screen application that will run on most computer hardware. AID will provide access to the key learning technologies instructors require to work in a virtual environment without having to be concerned about the technical aspects of technologies so some of the impediments to adoption institution –wide are removed.

On successful completion of the AID study, the third phase of the Dynamic Education project can be conducted which will incorporate the first two phases but step up the interactivity through the use of multi-media communications technologies. The main objective of Phase 3 is to:

- Maximise student interaction and engagement through a virtual classroom environment which will provide the opportunity for students to attend the actual class session live (synchronously); those that can not for time differences or other reasons can play the session in their own time (asynchronously).

The intended virtual classroom will have the look, touch, feel and interaction as if the distant student is in the actual classroom. It is then that we will have a truly dynamic learning and teaching environment for all our students, not just those on campus. Universities must face the inevitable that the ‘bricks-and-mortar’ classroom are not the only way to deliver learning and may eventually give way to virtual environments that are more effective.

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